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...We would like to thank the following American Peace Corps Volunteers, India 14 for their time, effort and excellent contributions...

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...Sincere thanks to...

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VEGETABLE GARDENING HANDBOOK

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I. Introduction

Vegetables should be a significant part of every person's daily diet. They provide the necessary vitamins and minerals which the diets of many Indian families lack. Due to the scarcity of animal sources, vegetables, especially beans and peas, provide also the protein necessary for body building.

Vegetables are usually grown in some form in villages in India. Creeper vegetables and patches of chillis are the most common. It is, however, rare to see a garden with variety and a quantity sufficient for the needs of an average family. In many areas, nutritious vegetables are simply not available or are too expensive, usually because of transportation costs and difficulties. Vegetables such as cabbage, knol kohl, and cauliflower are in very short supply in most areas.

Lack of availability and high prices are both problems which can be answered by an extensive kitchen and school gardening program. A producing kitchen garden will pay for itself in both health and financial terms. A school garden will contribute to the health of the children and teach them the methods and value of such a project. A garden will add to the total food production in India and will especially help remedy the acute shortage of highly nutritious food.

The fundamentals of good, inexpensive gardening are not difficult, but in each some problems will be encountered. These fundamentals and some methods of dealing with problems are presented in this book. The charts, diagrams and suggestions can be used not only for your own garden project, but for teaching and encouraging others.

When using the handbook, read the entire book through one time before beginning the garden and then refer to it as needed. Keep checking the chapter on "Simple Steps" in gardening, referring back as necessary to specific sections. Carefully plan your garden using the suggestions of the "Planning" chapter and the charts in the appendix. But keep this advice in mind—no rule, method or suggestion is inflexible. Because it is here in black and white is not good enough reason for doing it exactly that way. Adaptation to each local situation must be made. In each case your garden may be lacking something—enough fertilizer, good drainage, etc. Work around these problems and be willing to experiment with these and your own ideas. Changes are the essence of progress, not only for the developing country, but also for the PCV. Remember—a good garden is one that produces good vegetables continuously and inexpensively, regardless of method.

II. Tools

In preparing a garden, one of the first questions which will concern you is what tools you must use. In each area some tools will be available and others unheard of. The suggestions for necessary implements given below are only that—suggestions. Look around you and be sure to ask local people what is commonly used and available.

Plowing and turning the soil : In most cases, it will be possible to have a local farmer bring his bullocks and plow to your garden and plow it for a minimal sum. However, a major problem in Indian agriculture is that the plows commonly used do not turn the soil very deeply. The ground should be dug up to a depth of at least eight inches. It is best to look for a steel or mouldboard plow in the area and borrow it, but it will then be necessary to use strong, healthy bullocks. Use of such a plow in your garden will be a good demonstration of its value. For information about this plow, ask the nearest Agricultural Extension Officer.

You may find it necessary to turn the soil by hand, especially if the plot is a small one. For this you may use crowbars, shovels if available, and/or the common short-handled board hoe. (This tool may be called a para in some areas. See illustration 1.) Turning the soil by hand will be time consuming work and difficult in many cases. One good suggestion: Whether you are doing the work by hand or with bullocks, wet down the area thoroughly before digging. Just pour water continuously onto the area until it is soaked to a reasonable depth. This is a necessary procedure especially in the dry season or with very hard clay soil.

Cleaning the garden area : You may have to clear away some undergrowth from the area. For this you may use short curved knives common to many areas (See illustration 2) and the hoes. The knives may be used to cut and hack large limbs or thorny protrusions and the hoes for digging out the roots. Rakes for clearing small stones and leaves and sticks may be obtained in some areas or may be made cheaply. A bamboo handle, straw, and wire or twine will help you to invent your own. (See illustration 3.) However, large stones, bricks, sticks, and grass roots will need to be cleared by hand in most cases.

Leveling : The makeshift rake suggested above can level and smooth your garden area. Probably the most effective method, however, to break up the clods and smooth it by using your hands.

Watering : For many gardens, especially smaller ones, the best watering

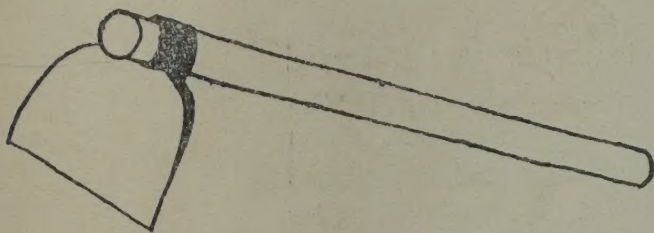
method is to use a watering can. This can sometimes be found if you ask for a "rose-can." The watering can has a spout covered with a small, perforated cover. (See illustration 4.) You can have one made easily in a village by drawing a picture and showing it to a local tinsmith. Another method of hand-watering is to scoop water with both hands from a shallow basin or a bucket. If you use this hand method, remember to break the fall of the water. Water poured directly onto newly-planted seeds or small plants will wash them away or effectively drown them. You can pour water over a board to break the fall of the water, also. (See illustration 5.)

Weeding : If trowels are available, use them. The important part of a weed is the root, not the top. It will be no good to merely pluck off the top growth of a weed. You must dig deep and get the root to prevent re-growth. You can make an effective weeder by buying a two-foot length of metal rod and having a local tinsmith or metalworker beat one end flat and split it. (See illustration 6.) If you have nothing else, use a stick and your fingers to get at the root. Stick the stick into the soil 5-6 inches and using your fingers reach down and pull up the root. (See illustration 7.) Remember to smooth over the disturbed soil after weeding in order to prevent erosion, air getting to the roots of the plants in the garden, and for the sake of appearance.

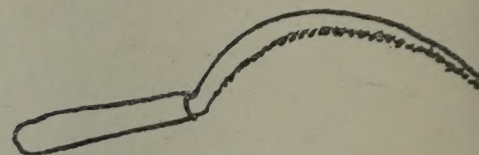
Do not be alarmed if few of these tools are available in your area. Many of them you can make or have made cheaply. Also, many a kitchen garden can be done well with only a hoe and your hands. Your hands are still the most important tools you have. Don't be afraid to use them. But, it is good to experiment when possible with improvised tools. Introduction of long-handled implements may be one of your biggest contributions to a gardening program. Use your imagination and improvise.

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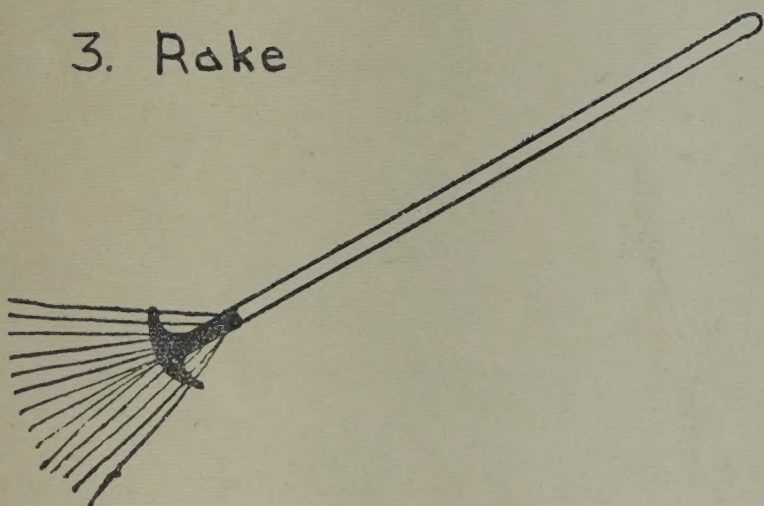
1. Hoe or Para



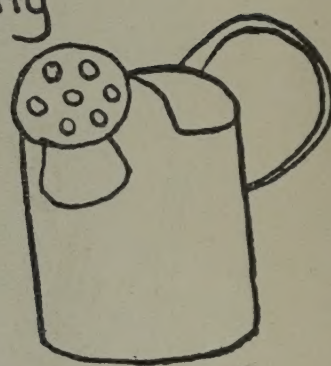
2. Knife

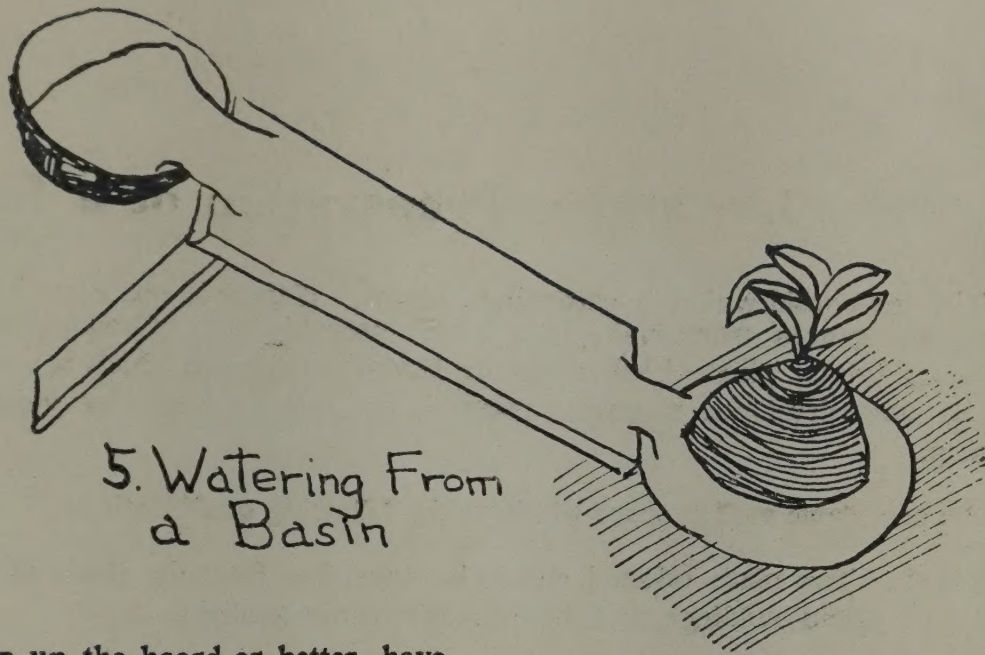


3. Rake



4. Watering
can



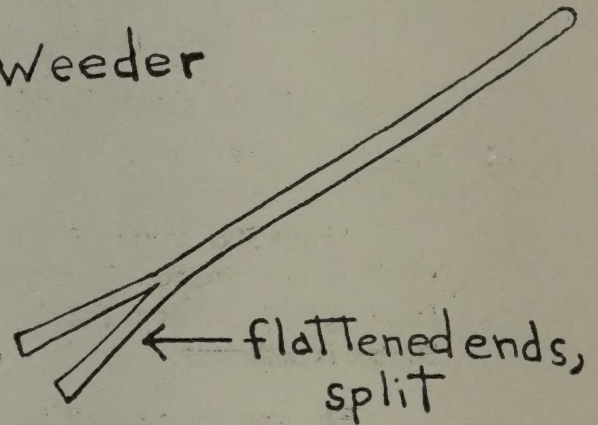


5. Watering From a Basin

(You can prop up the board or better, have someone hold it at an angle.)

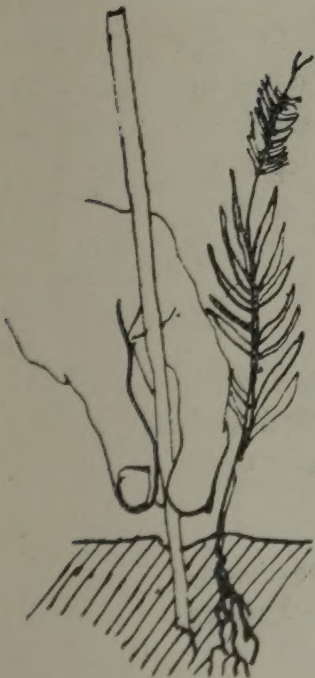
Guide the stick with your finger.

6. Weeder

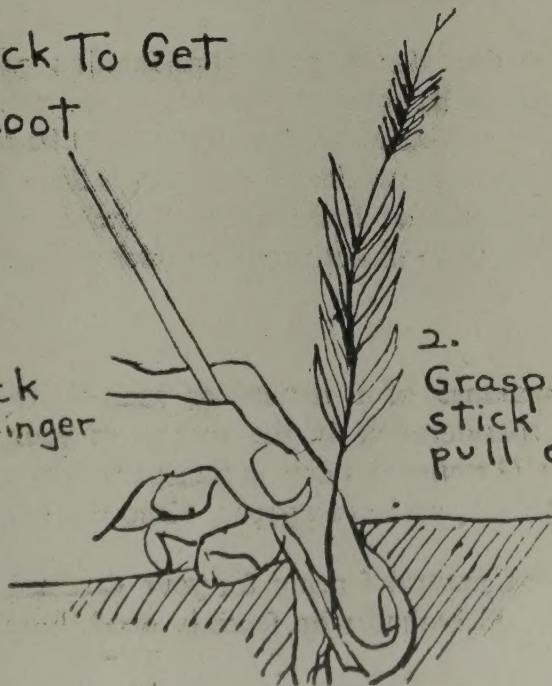


Grasp the root and stick together and pull.

Using A Stick To Get At The Root



1. Guide the stick with your finger



2. Grasp the root and stick together, and pull out.

III. Selection and a Preparation of a Site

The first consideration in gardening is space. If there is not enough land to make the garden worthwhile, then it will probably fail. Growing a few tomato and brinjal plants haphazardly or having a backyard which is a small jungle of underdeveloped vegetable plants is not what is meant by vegetable gardening.

An acceptable garden space will have the following qualifications:

1. The place selected should be open, free from the shade of trees and buildings, and should receive direct sunlight.
2. It should not be in a low-lying area since rain water may accumulate during the monsoon seasons.
3. It should be relatively free from rocks; the more top soil the better.

Size:

About 500 square feet of land can give enough vegetables to supply the needs of one person. Therefore, a garden measuring as little as 20 feet by 20 feet is feasible. For a family of five persons, a plot approximately 100 feet by 30 feet is sufficient.

The space is utilized best if it is in one plot or contiguous smaller plots. It is difficult to care for a garden which is spread out in small scattered plots.

Water:

In America, the second consideration after space is the type of soil available. In India, however, the next consideration is always the availability of water. For a successful garden, water must be readily available, whether from a well, a pump or a municipal tap. In village homes with no easy access to water the utilization of bathroom and kitchen waste water may be the answer. However, often this will not provide sufficient water for the garden.

Fencing:

The presence of a natural or man-made fence or enclosure is a very important consideration in the success of your garden. A school or house compound will sometimes have a cement wall or a fence. Be sure it is of proper height (4' to 5') and has no gaps. Keep the gate closed at all times.

The best natural fencing for your garden is a thick hedge or a live thorn-bush fence. A barbed wire fence is good, but very expensive and not really

necessary. If barbed wire is available, use it in conjunction with a hedge or live fence, for barbed wire will not keep out pigs which root under the fence.

There are several kinds of natural fencing. The most common are prosopis, glyricidia, and lantana. Seeds, seedlings or slips for these plants are available in most seed stores, or you may contact the Agricultural Extension Officer at Block Headquarters.

The procedure for planting is as follows: Dig a trench one foot deep and one foot wide for the seedlings or slips, let the soil dry out, place your seedlings or slips in the trench, cover over and wait. Little or no extra watering and care is required. Both prosopis and glyricidia should be planted in two or three parallel rows or trenches for greater effectiveness. Prosopis Juli Flora is a thorny bush with a sharp taste which animals do not like, is sturdy and comes to maturity in about one year. It should be planted just before the monsoon season. Glyricidia is not so sturdy, but likewise has an unpleasant taste; it will reach 12 feet in height during the first year. Glyricidia is best if planted in June or September. Since Glyricidia is often used for composting or green manuring, it may be pruned twice a year for this purpose. (See Chapter IV.)

A bamboo, lattice-work fence or a matting fence may also be used for protection of the garden. But, if pigs are common in the area or if cows frequent the spot, be sure to brace the fence well. Bracing may be done by sinking poles one foot into the ground and securely tying or wiring the fence to them. It may even be necessary to dig a trench one foot deep and actually sink the lower portion of the fence, filling the trench back in with stones and hard-packed dirt. The latter method will usually prevent pigs from burrowing under the fence.

Soil:

For growing vegetables, the soil should be loose, friable, and at least one or two feet deep to permit the growth of deep-rooted vegetables. The lay of the land should be such that water does not collect at one place. Irrigation water should be able to soak freely into the soil. Most soils, whether they are red, black, or sandy, share these characteristics and are thus suitable for some kinds of vegetables. Soils that are not good for vegetable gardening are those which are over-alkaline, those which contain an excess of salts and those which do not allow suitable drainage. Proper soil management can improve even those soils and make them useful for gardening.

Soil Testing:

If you are planning a comparatively large vegetable crop—if it is to be a large cash crop of an acre or more—it pays to know as much about the soil condition as possible. The most accurate and complete source of information about the condition of your soil is chemical soil testing. This testing is done by the State Agricultural University in most areas. Your Samithi Headquarters may have soil testing equipment also.

To take a soil sample for testing, it is necessary to obtain a representative sample from different sections of the plot. One good method is to use a pipe or similar hollow tube. Drive the pipe into semi-damp soil 6" to 8" deep. The soil will stick in the tube and can be knocked out. Another method is to dig a small hole and scrape along the side of it with your hand from the bottom up. In this way you obtain a sample of the top six inches of soil. Take such a sample from four or five different places, mix them, and send a sample from this mixture to the soil testing station in your area. If there is a great variance in the types of land within the proposed garden area, two separate samples may be taken. Include complete information about the crops you intend to raise on this land.

The results of a soil test will tell you about the relative acidity and salt content of the soil and about the nutrient needs of the soil for different crops. But since vegetable gardening is usually a small-scale operation, a soil test will be rarely necessary. Often you may spend your time and money in more profitable ways. If you follow the general principles of soil management and use enough fertilizer, usually your plot will be successful anyway.

Soil Management:

After cleaning up the soil in general by removing rocks and other extraneous matter, the first operation in working a garden is plowing. Plowing may be done by tractor, wooden plow, or a mouldboard (steel) plow. The idea is to plow as deeply as possible at least 6" to 9" deep.

Make the best of whatever soil you have. If the soil is heavy clay, a lot of compost or manure is necessary and it is advantageous to add a lot of fine sand dug in deeply. More compost or sand is necessary if moist soil, when squeezed into a ball, cakes and holds its shape. If the soil is too sandy, and does not retain moisture easily, add red clay soil, black soil, or tank-bottom soil to get the right consistency.

Proper manuring cannot be stressed too much. In improving the soil structure, the quickest method is to apply enough manure. A good rule is to apply about $\frac{1}{2}$ cartload of farmyard manure or compost for every 100 square feet. These organic manures improve the fertility and the structure of the soil. A good structure increases the water-holding capacity of the soil and facilitates the draining of excess water. If the soil has a good structure, the plant nutrients are more accessible to the roots. Good structure also protects against erosion. Manures and fertilizers are both essential, manures to improve soil structure and fertilizers to release plant nutrients and increase the fertility of the soil. (For details about plant nutrients, specific fertilizers, and procedure, see Chapter IV.)

Crop rotation is a sound practice. It helps prevent specific plant diseases from recurring and keeps the soil nutrients in a balanced condition throughout the garden. Alternating long and short term crops, leguminous and non-leguminous, leafy vegetables with root crops according to the season is good cropping practice.

Proper cultivation methods are also helpful in improving and maintaining soil structure. The standing crop has a strong influence on the soil. Vegetation covers the soil and protects it against too much sun, rain and wind. It makes the soil more friable and helps to open up the subsoil. So it is a good practice never to let the land lie barren longer than necessary to prepare for the next crop. Leaving a ploughed field unplanted is bad practice as the soil is very easily eroded. During the hot season of the year, when many vegetables may not thrive in the garden, plant a green manure crop to keep the soil in good condition and prepare it for the coming garden season. (See Chapter IV.)

IV. Fertilizers and Manures

The term 'fertilizer' pertains usually to chemical fertilizers which, as they dissolve, add certain elements to the soil. 'Manures' refers to animal waste such as cow dung, chicken litter, urine and bedding, and compost. Other manures are groundnut (peanut) cakes, castor and neem and cotton seed cakes. These cakes are rich in nitrogen, phosphorus and potassium. Green manuring crops are those which add organic matter to the soil by decomposing and make existing elements in the soil more readily available. Legumes add nitrogen to the soil. The most common green manure crops in India are sunhemp, urid, mung, singi, glyricidia, dhaincha and indigo.

There are sixteen elements essential to plant growth. The elements are carbon, hydrogen and oxygen, nitrogen, phosphorus, and potassium used in large amounts from complete fertilizers and calcium, magnesium, sulphur, iron, zinc, boron, copper, manganese, molybdenum and chlorine. Of these, nitrogen, phosphorus and potassium will be your major concern. Lack of any of those listed above will limit plant growth. The availability of essential minerals in most soils is so lacking that the use of fertilizers and manures is necessary.

All crops require about the same amount of phosphorus and potassium. These fertilizers penetrate the soil less quickly than do nitrogenous fertilizers. It is best to plow them into the soil before planting. Ideally, previously uncultivated land should be plowed three times. The compost, phosphorous and potassium should be added before the final plowing.

Nitrogenous fertilizers need not be worked into the soil ; with irrigation water, nitrogen quickly penetrates to deeper layers. The roots can only take up the nutrients when they are in solution with water. Thus a regular water supply is of vital importance in plant feeding.

Kinds of chemical fertilizers and their use :

Ammonium phosphate contains 16% nitrogen, 20.5% phosphorus, and 14% sulphur. In granular form it readily dissolves and penetrates the soil for greater distances than the soluble parts of superphosphate. It can be applied at the time of tillage or at the time of sowing with the danger of harm to the seed germination.

Ammonium sulphate is a white crystalline powder and contains 20% nitrogen. It is water soluble and readily available to the crops. Since it produces acidity in the soil, it should be used in conjunction with bulky organic manures, i. e., farmyard manure and compost. It is applied prior to sowing or during the growing period of crops. It is *not* applied with the seed. Because

it is retained by soil particles, it is more suitable for wetland paddy and jute. *Ammonium sulphate nitrate* is a fine, white crystalline product. It also comes in granular form and has a dirty white color. It contains 26% nitrate, is useful for all crops, and is applied prior to but *not* with the seeds.

Urea, obtained in the form of fine, white crystals, contains 45% nitrogen. The soil should be dry at the time of application. Urea should be mixed with earth or sand and distributed uniformly over the field.

Superphosphate is the most commonly used fertilizer in India. It is a brownish-grey powder and contains 16-20% phosphoric acid. Used for all crops, it is applied before the time of sowing. The best method of application is to put it into the soil to a depth of four to six inches. It is applied one to two inches away on either side of a row of seeds.

As noted above, nitrogenous fertilizers need not be worked into the soil, while phosphorus fertilizers penetrate slowly and thus must be mixed into the soil. For nitrogen a distinction of crops is necessary since the soil can only store a limited amount of nitrogen. Vegetables like leafy vegetables, cabbage, and long-growing-period vegetables like tomatoes and brinjals need extra nitrogen.

Add water immediately after the application of chemical fertilizers.

Kinds of manures and their application :

Farmyard manure, green manure, and compost all help to improve the soil. Decomposing manures loosen the soil and release plant nutrients. The value of these manures lies in the fact that they produce humus which is added to the soil. Bulky organic manures improve soils that form hard crusts in the sun, disintegrate and blow away, or is coarse or compact below the depth of tillage.

Farmyard manure, e. g., cow dung, contains .5—1.5% nitrogen, .8% phosphoric acid and 1% potash (potassium). These food elements are made available after the manure is mixed with the soil. Light, sandy soils benefit from adequate applications of tank silt. This improves and strengthens the structure and increases water holding capacity. Clay soils break into clods when cultivated. The addition of lime or gypsum makes the soil less sticky. The farmyard manure should be well rotted and applied to the soil well in advance of the sowing time. It is beneficial to all crops, and its beneficial effect persists over a number of years.

Green manure crops such as sunhemp, peas, glyricidia, and dhaincha add organic matter to the soil. They improve the nitrogen fixation quality of the soil. It is possible to grow such a crop and plow it under in the flowering stage. Dhaincha, for example, is highly recommended as the best plant for green manuring and for composting (see below). Seeds are available at most seed stores or from the Agricultural Extension Officer in your Block. Six weeks after planting you can plow it under for green manure.

Using green manure properly may be the most practical way to improve the soil over a long period. It is good to have part of your garden under green manure or leguminous crops such as field beans all year around. During the summer months when it is too hot to grow most vegetables much of the garden may be put in green manure.

Be sure to note that glyricida, mentioned in Chapter III as live fencing material, is also good for green manuring. In addition, the plant may be pruned and the excess used for composting.

Two points to keep in mind when plowing under a green manure crop :

(1) It is best if the soil is wet to facilitate decomposition. (2) Nitrogen if added to the soil will help decomposition and add to the fertility of the soil-green manure mixture.

Chicken litter or manure is one of the best fertilizers available. Deep litter is the waste material, grass, straw, leaves of whatever is at hand, which covers the floor of a poultry shed or house. Due to a slow bacterial process the bird droppings mixed with the litter over a period of a year becomes the best organic fertilizer known. No work is necessary except the ordinary care and feeding of the birds. If there is no poultry project nearby, it may be possible to purchase some litter as fertilizer from a more distant project. Contact the AEO and/or the District Animal Husbandry Officer for information. Not only is this fertilizer (manure) useful for vegetable gardens, but paddy and sugar cane crop yields can be demonstrably increased by its use. Be sure to inquire in your area as to the availability of this product.

Compost is prepared from vegetable waste and other refuse mixed with cow dung, straw, bedding and urine. The refuse is allowed to decompose in a large pit or in a stack. This bulky organic manure should be mixed well into the soil to a depth of 8"—10" or more since it improves the soil by producing a rich soil called humus.

Compost Pits : Pit method and stack method :

In areas receiving less than 30 inches of rainfall per year, the pit method is recommended; in more humid area such as the seacoast, the heap or stack method is used.

To prepare a pit, dig a hole approximately three feet deep. Below that depth, the decomposition process is not as efficient. The width and length are somewhat dependent on space, the availability of waste materials, and the the availability of labor. For a school garden of 400-500 square feet, a good size would be one pit 5' × 10' or 6' × 12'. For $\frac{1}{4}$ acre, two pits of 10' × 20' are advisable.

The pit should be filled in layers. It does not matter if a week or two elapse between each layer's completion. Cover the bottom of the pit with a six

inch layer of tree leaves, straw, bushes, garbage, town refuse, sugar cane refuse, and/or a green manure crop such as glyricidia. Any non-woody organic waste either green or dried may be used. (The woodier the waste matter, the longer the decomposition process will take.) If available, sprinkle a handful of Superphosphate on the waste layer. This will facilitate release of the phosphoric acid in the decomposition process thus making more of the phosphorus available for plant use. Trample the layer firm and compress it.

Next add a layer of farmyard manure (chicken litter, cow dung) and cover with a 1" layer of soil. Again trample it firm. An alternative method at this point is to make a solution of cow dung and water, about the color of tea, and thoroughly soak the waste layer. This solution can be mixed in large quantities in a cement-lined pit or by the bucketful. This second method is especially good if your supply of manure is limited. Whichever method is used (waste layer, manure layer, soil or waste layer followed by cow-dung and water solution), after compression and/or saturation the layer should be about 8" to 1' in depth.

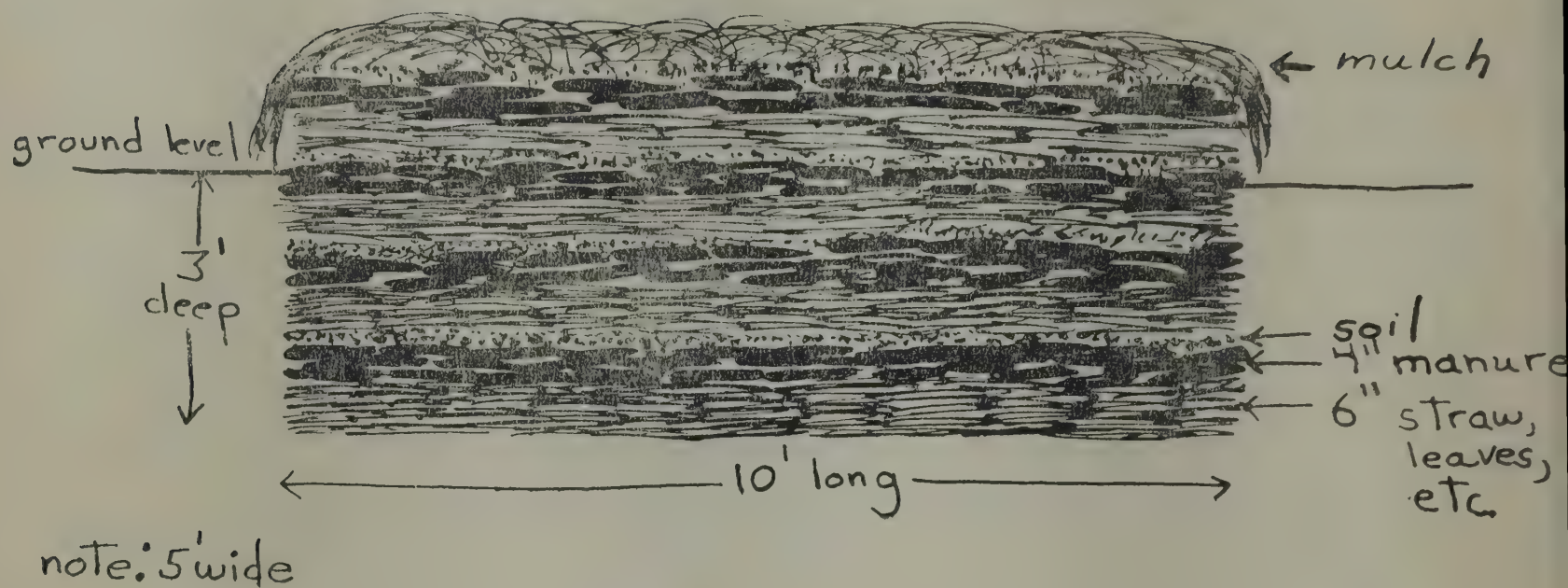
The filling continues until the pile is at least 1' (2' is better) above the ground. The top of the pile should then be completely covered with soil. (See Chapter X). The compost will be ready for use in approximately 5-7 months. (See illustration 8.)

To prepare a stack or heap, select a well-drained spot, add each layer in such a way that you have a circular heap about six feet in diameter and six feet tall. Plaster the top with mud to prevent leeching away of plant nutrients. The compost is ready for use when needed. (See illustration 9.)

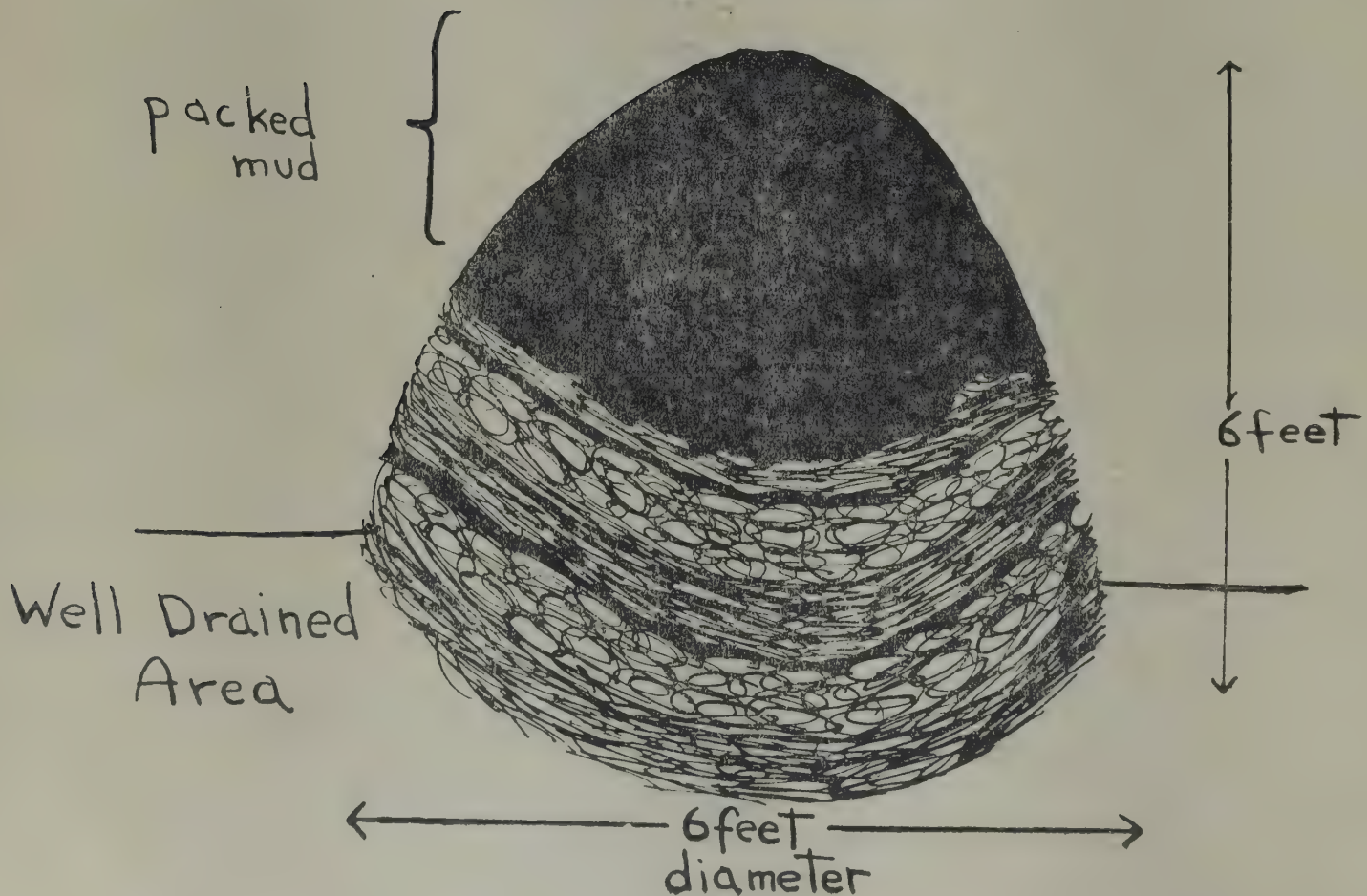
Note well : If you decide to use night soil (human excreta) in the compost pit, you must wait at least six months *after* the last addition before you use the compost as manure for your garden.

The soil and climate condition in India vary a great deal from place to place, state to state. It is recommended that the State Agricultural Departments be consulted for the exact quantity and type of fertilizer to be used. As a general rule, however, bulky organic manures or compost should be applied to all soils. A dose of three to five cartloads per acre is sufficient for crops grown in areas receiving less than 30" of rainfall. In places receiving more than 30" of assured rainfall, a dose of five to ten cartloads per acre is recommended.

Compost Pit



Stack Compost



Fertilizer Table and Suggested Amounts and Methods :

The following table can be used as a quick guide to the rate of application of chemical and organic fertilizers for a 25'×20' garden (approximately 500 square feet). When two or more of the materials are used together, reduce the amounts accordingly.

<i>Type of Fert./Manure</i>	<i>Suggested Amt. (lbs)</i>	<i>Suggested Amt. Kilo- grams)</i>	<i>Method & Time</i>
Ammonium Phosphate	8-13	3-5	When plowing or sowing.
Ammonium Sulphate	6-9	2-4	Mix with compost/ manure. Put before sowing or during growth <i>not</i> with seed. Irrigate
Urea	3-5	1-2	Mix with sand or earth. Put before sowing. Irrigate.
Superphosphate	4-5	1.8-2.2	Before sowing.
Farmyard Manure, dry	225-625	104-284	Before sowing.
Chicken litter, dry	75-150	34-74	Before sowing.

**The important thing is to *use* fertilizer and compost. If you do not have the required amount or the best type as per the information from this chapter, make use of what you have. Almost any of the above will improve the soil and your vegetables.

V. Seeds

In order to have a large, healthy yield of vegetables, you must start with a healthy, proven variety of seed. To be safe, you should use fresh seed purchased from a government agency or a reliable private seed company. Find out what variety will grow best under the conditions in which you intend to plant. If you have a quantity of old seed and doubt its reliability, you can check the percentage germination with a simple test: (See illustration 10.)

1. Count out a number of seeds and record the number. Use approximately 50 small seeds or 25 large ones.
2. Moisten a single sheet of folded newspaper and place the seeds on the wet paper, separated from each other.
3. Roll up the newspaper, making sure the seeds do not touch each other, and fold in half.
4. Insert the rolled paper in a drinking glass turned upside down. Let some newspaper stick out in order to create an air space.
5. Check the percentage germination every four days.
6. After eight days, compute the percentage germination and plant accordingly. (For example, if you have 50% germination, plant twice as many seeds as you wish to have plants in the garden.)

When you purchase seeds, find out if they have been treated with a fungicide. If not, you should do so. There are various commercial preparations available at seed dealers, agricultural supply houses and government agencies. Two examples of good commercial preparations are *Agrosan* and *Ceresan*. (See 6 listed in the Insecticide/Fungicide chart at the end of Chapter VIII.) Lightly dust the seeds with the powder, making sure all are treated.

Much research is being done in improving seed varieties, and in breeding vegetables that are suited to Indian conditions and resistant to diseases peculiar to India. Where possible, you should always use proven selected varieties. In the appendix to this book, some improved varieties of each type of vegetable cited are given.

There are a number of private nurseries that will send mail order seed catalogues to you upon request, along with a price list:

1. Pocha's Seeds, Pestonjee P. Pocha & Sons, Poona 1, Maharashtra

2. The Deccan Seed Store, 46 Purushottam Nivas, Bashir Bagh, Hyderabad, A.P.
3. Government Vegetable Nurseries
4. Vishnoo Sadashiv & Co., Seed Merchants, Post Box No. 24, Poona 1, Maharashtra
5. Sutton's Seeds, Sutton & Sons, Ltd., 13-D, Russell Street, Calcutta 16, West Bengal
6. National Seeds Corporation Ltd. (Govt. Undertaking), F-35 South Extension, Part I, Ring Road, New Delhi-3

A number of government sources have seeds readily available :

In the village—village level worker (gram sevik)

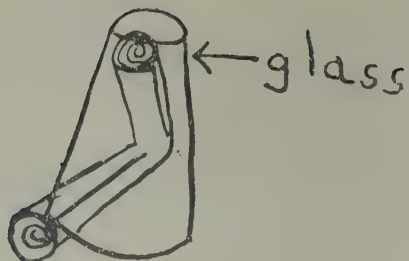
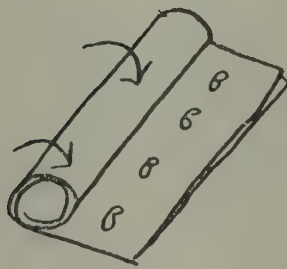
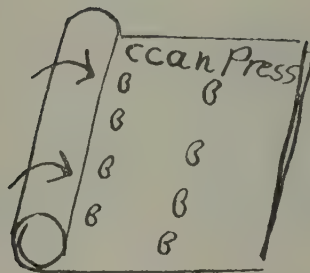
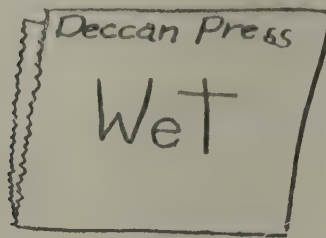
At the Block—Agricultural Extension Officer, Block Development Officer

At the District Headquarters—District Agricultural Officer

In a municipality —Agricultural Assistant

Sometimes government research farms will have seeds available also. These research stations are a good place to obtain information on which varieties of seeds grow best in your particular area. For further details, write to the State Agriculture Departments, research stations, agriculture universities, and/or private companies nearest to you. A partial list of these is given in the appendix. Check with the Forestry Department in your State also. (They may not only have seeds, but perhaps seedlings and slips of green manure crops also.)

10. Seed Test



VI. Seed Beds and Transplanting

Seed Beds:

Many vegetables such as beans, gourd, and green leafy vegetables (e.g., spinach) may be sown directly into ridges or flat beds. But vegetables such as tomato, brinjal, cauliflower, lettuce, cabbage, and knol kohl (kohl rabi) are sown into beds and transplanted into the garden later. This is because these vegetables need extra care in their early growing period and, though small and delicate at first, must be planted at larger intervals than other plants after their first growth. Where seedlings are not easily available from a vegetable research station or a private nursery, a seed bed of your own is necessary.

1. Choosing a good site: The seed bed will need a fence, just as your major garden will. The same suggestions as those mentioned in Chapter III may be followed. The water supply should be close at hand, since extra and frequent care is necessary. There should be moderate shade especially in the afternoon and in the hot season. Trees and the shadow of a building are good protection from the hot afternoon sun. The area should be well drained.
2. Preparing the soil: Dig the soil deep and break it up well. Often it may be necessary to mix soils (sand and clay) to get a medium texture, neither too heavy nor too light. Mix in farmyard manure (well rotted) or compost, and add some superphosphate, a common fertilizer. The amount of superphosphate should be based on this rule: Use approximately one pound (450 grams) per 100 square feet. For a bed 6' x 3' (18 square feet) approximately 100 grams would be necessary.
3. Making the seed bed: Raise each bed 4" to 8" high (from the ground level) and level the surface of the bed completely. This will prevent water accumulating in low spots and drowning some of the plants. Raise the edges of the bed slightly. Pat the soil on the slanted sides to prevent washing away. (See illustration 11.) A seed bed 6' x 3' will be easily watered and weeded. If a school garden seed bed is constructed, the width should be narrow (not over 3'). The children will then be able to reach the weeds in the centre easily.
4. Seeds may be sown by broadcasting (Loosely scattering seed over the entire surface) or in lines. Since the seeds are generally small, mix fine dry sand with the seeds before sowing. This will prevent having the seeds too close together in the seed bed. If you plant in lines, a very shallow ($\frac{1}{4}$ inch) finger trench may be made. (See illustration 12.) Whichever method is used, cover the seeds lightly and water immedi-

ately. Sprinkle the water easily over the bed. In the hot season especially, mulch may be placed on the surface to prevent packing of the soil and escape of moisture. The mulch may be removed after the seedlings emerge. (See Chapter X.)

5. Water the bed with a watering can with a nozzle or by hand. In any case, be sure to break the fall of the water so that the seeds are not washed away. It is easy to check the depth of water and the condition of the soil at the roots by digging down with a stick for several inches. Morning and evenings are the best time to water, not mid-afternoon. Water thoroughly rather than frequently after the seedlings come up.
6. Remember that seedlings are delicate and will need frequent care. Dust or spray to control insects and disease just as in the larger garden. (See Chapter VIII.) Weeding and cultivation are very necessary for strong seedlings, and thinning will give each plant sufficient room to grow. A good seedling will have large leaves, loosely spaced, be wider rather than tall, and have a good root system.

Transplanting:

Before transplanting, the garden should have been prepared properly by plowing, levelling, and manuring. Ordinarily you will have left some space in your garden for the transplants when planting other seeds directly. When the seedlings are 4" to 8" tall, they may be transplanted. Larger seedlings usually will stand the shock of transplanting with more ease. Be sure to transplant in the morning or evening when the heat from the sun is least. Wet down the seed bed thoroughly (deeply) before beginning the transplanting operation.

1. Remove the seedlings from the bed by digging deep away from the plants to save the side roots and lifting out carefully. You may lift them out in bunches and separate carefully only when actually placing the plants in the garden. If they cannot be immediately transplanted, wrap the roots and the soil clinging to them in wet newspaper or leaves after watering them thoroughly.
2. Plant one seedling per hole and water immediately. (See illustration 13.) If you doubt the viability of the plants, you may put more than one. After three days remove all but the strongest and biggest. Do not disturb the ones left in the garden when doing so.
3. Keep some seedlings in the seed bed as a reserve. Wait three to five days to make sure that a transplant is successful. If not, you may use the reserve plants. But remember—the shock of transplanting will often make a seedling wilt and appear dead when it is not. Give each one a chance to regain strength.
4. Care for the transplants from this time on as for the other plants in your garden.

Seed Beds

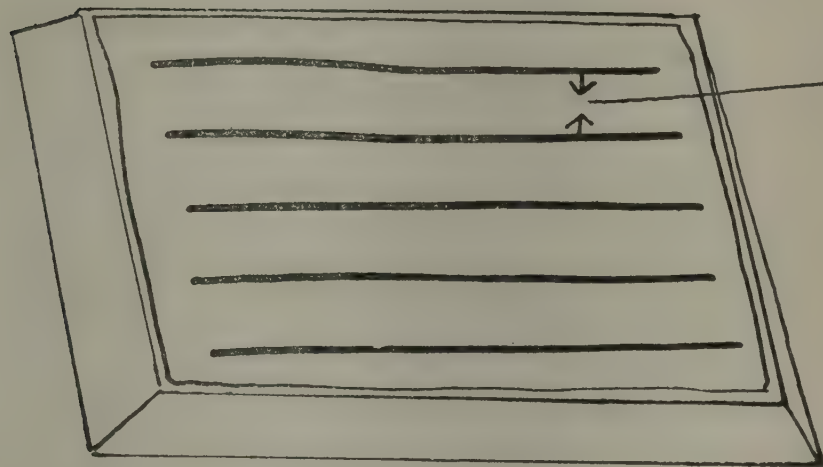
Raised edges

Level

3'

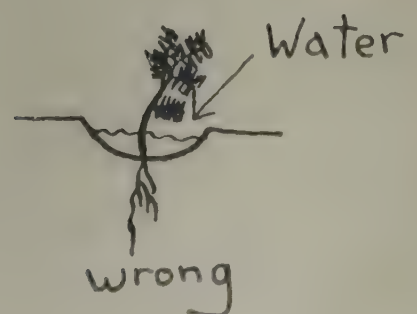
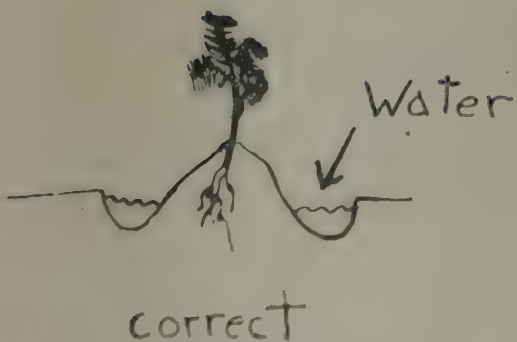
4"-8"

6'



about
6"-8"

13 Transplanting



VII. Water and Irrigation

India depends upon the monsoon for water for irrigation. But the kitchen gardener should not count on these “seasons.” The rains come sometimes in deluge, often at the wrong time, and sometimes not at all. As a rule, however, the rainy season means full wells and tanks—plenty of water. But in some parts of India, this is a mere three months, followed by winter and then the hot season. During the hot season many wells dry up, almost all tanks are dry, and city water supplies are cut short. Find out in advance the full water situation in your area—rains, wells, tanks, and/or the municipality water supply. Always be aware of the possibility that though the situation is supposed to be “this” way, it often is not.

During the rains many areas become waterlogged. Make certain that your garden has proper drainage. Never use a flat bed during the rains—you’ll end up with a tank, not a garden. The plants must be on small mounds or rows with furrows between so your plants will not drown.

During most of the year, many gardens must be watered by hand. Since this means carrying buckets of water, locate your garden near a water source. In pouring the water, use a board or your hand to prevent the rush of water washing away the soil.

Methods of Irrigation :

The way you arrange your garden and the method of irrigation depends upon the availability of water—whether it comes from a flowing source or a well or tank.

1. Round furrows and mounds : Dig a furrow around the plant and pile up dirt around the stem. The furrow should be large enough to fall under the tips of the leaves of the mature plant. Pour water by hand into the furrow. The water will then go to the roots, which are under the leaves, and not to the stem. Water standing around the stem of a plant will cause rot. (See illustration 14.)
2. Round tiles : This novel method of hand watering prevents loss of water through evaporation. (See illustration 15.) Once roots are established (after two or three weeks), insert round roofing tiles or clay pipes into the ground several inches. Scoop out the dirt rising in the pipe. Water poured into the pipe will go directly to the root area. As the plant grows, push the pipe deeper into the ground. If roofing

tiles are not available in your area, a potter can be commissioned to make them for about two naya paisa each.

3. Flat beds : When there is no rain and no drainage problem, certain crops may be flood-irrigated. Make a flat bed completely level with a bund (ridge) around it. Take care not to kill the plants by over-flooding. (See illustration 16.)
4. Canals (Rows and furrows) : This is the best, most universally applicable, and most fool-proof method. If there is a constant water supply, it is ideal. However, even when hand-watering is used, this method can be effective. It is important to set up the canal system properly. (See illustration 17.)
 - A. Level the land so that it is completely flat. If necessary, make terraces.
 - B. Dig a feeder canal on either end of the garden or terrace. This should be six inches deeper than the canals or furrows and should open into each row. The feeder canal will fill with water before any furrow fills up and all furrows will be filled gradually and evenly.

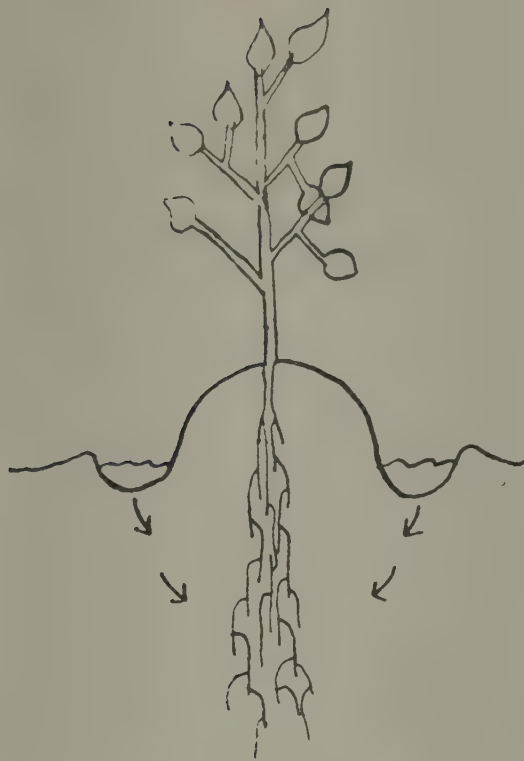
This idea is new to India. The old method is to have many short canals, each opened by hand to let water flow in and then closed up. This is much less efficient. However, many people like this method, and feel it is necessary because the ground is usually too irregular for long canals to be effective. Don't go along with the old method. The full-length canal system with a feeder canal is bound to be effective if you put in the initial effect. Level the ground accurately and test the level if necessary, using a spirit level or a test canal filled with water.

Frequency of Irrigation :

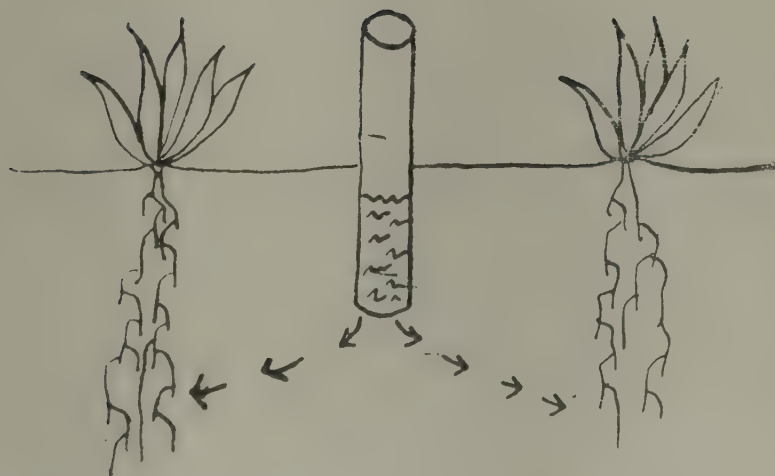
Young plants require daily watering. After a few days, begin to water less often. After two or three weeks, irrigate only once a week. In most cases, this will be sufficient. But don't follow an arbitrary rule. The season and type of soil will affect the watering schedule. The summer or hot season necessitates frequent irrigation. Clay soils spread the water out and water is absorbed more slowly. Sandy soil drains quickly and the water goes straight down. Check the soil to see whether water is needed. There should be water close to the surface (four to six inches) for the smaller roots which absorb more quickly, and water down at the anchor roots as well. Dig down at least one foot. The soil must be wet enough for water to be available to the roots. If it is only slightly damp, the soil itself will absorb the water that is present.

Thorough, but less frequent, watering is best. Thorough irrigation means soaking the soil. There are several advantages. First, the roots will be encouraged downward, thus making sturdier, healthier plants. Second, thorough irrigation is easier in the long run. You may need to irrigate twice in one morning, but this will mean no irrigation for a week. Third, frequent irrigation increases the chances of root rot, since the stem is constantly wet. The water level should not go above the place the stem begins (the seed level). Fourth, frequent irrigation will cake the soil on the ridges or mounds. After thorough irrigation, the top surface will dry out and may be kept loose more easily.

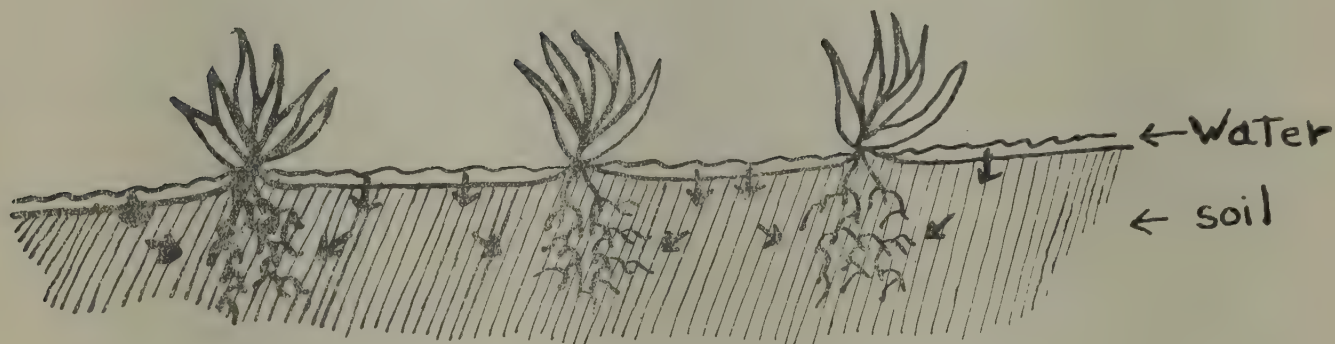
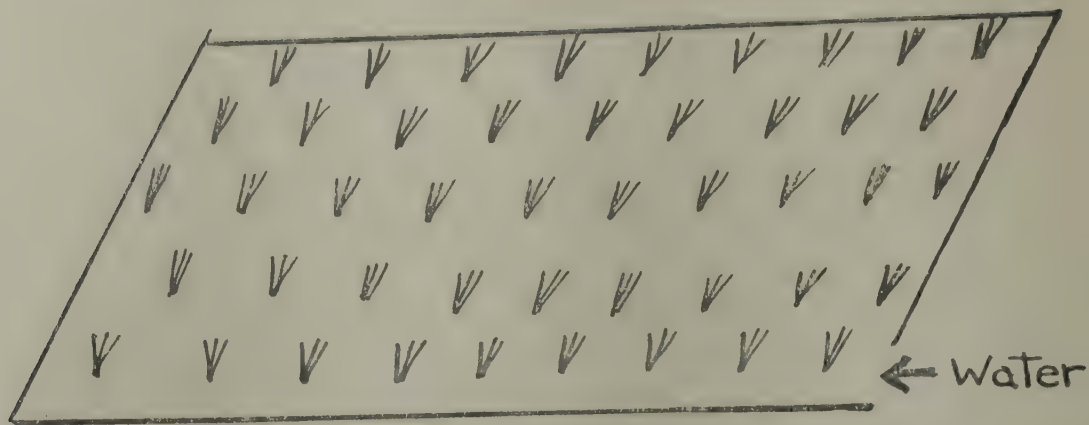
Remember, water is essential. A constant check on the need for irrigation is necessary to a successful garden.



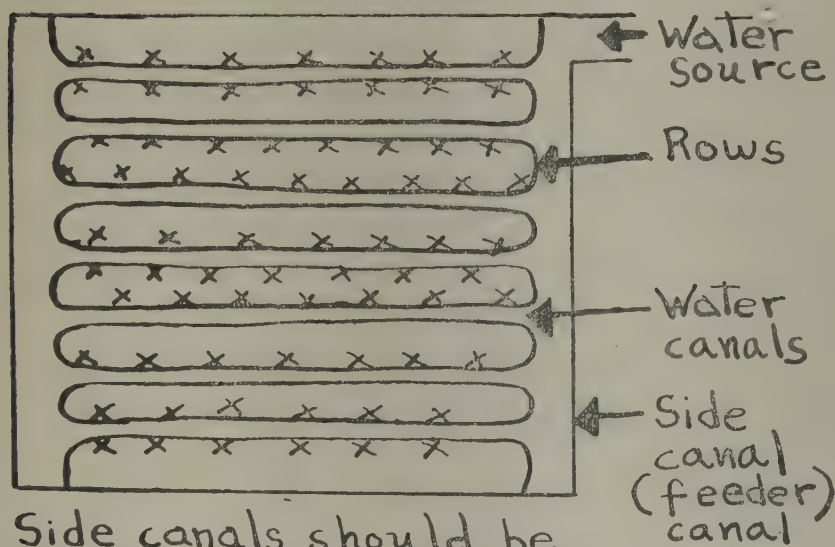
14. Put water in furrow around mound



15. Put water into buried clay pipe

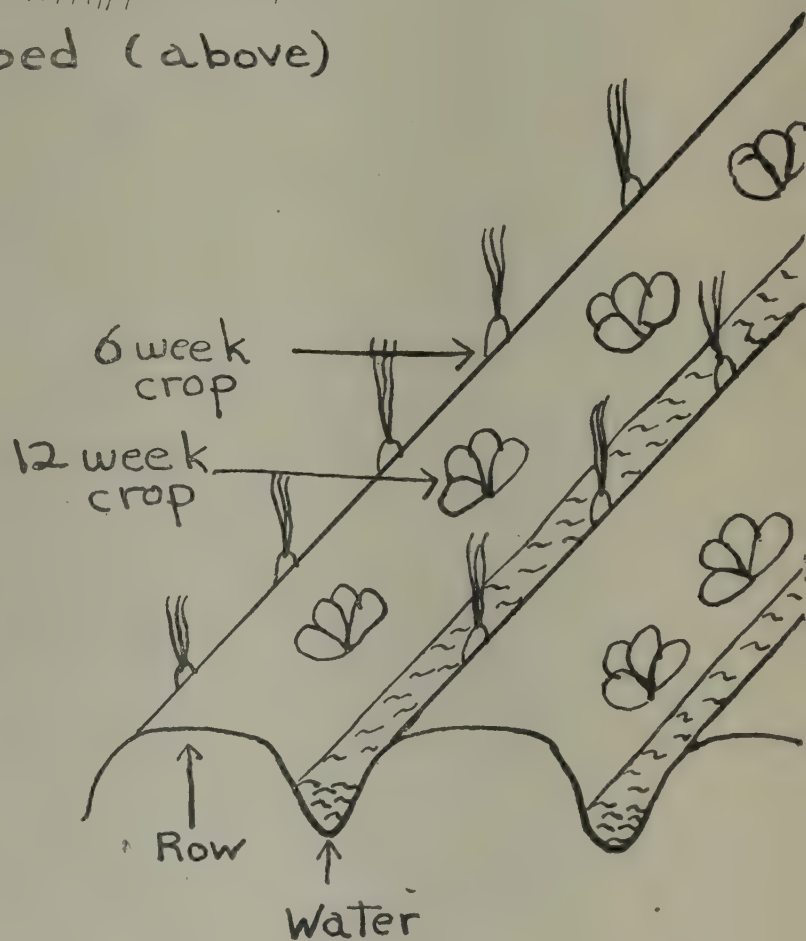


16. Plain flat bed (above)



Side canals should be deeper than row canals so the row canals fill evenly

x = plants (you can plant on one side of row or both sides of row)



17. Row and Furrow

VIII. Plant Protection

We raise vegetables for people, not for goats, cows, insects, fungus, or rats. Vegetables must be protected from pests and disease. (One goat can eat two gardens in one hour. How many gardens can three goats eat in $\frac{1}{2}$ hour?) There are four main categories of pests that will, if given the chance, infest your garden and destroy it: Large animals, insects, fungus, and virus.

Do not wait until your garden is infested with pests. Preventive measures must be taken. It is much easier to prevent pests than to treat for them. Dust seeds before sowing; build a fence before planting; spray for insects and fungus before you see their effects; pull out a plant infected with virus diseases and burn it before it spreads to other plants.

1. *Large animals:* Before you plant a garden, you must usually construct a fence. Of the many materials that can be used (stone, bamboo, matting, thornbush, live fences), probably the most effective will be a live fence combined with barbed wire. But the type of fence depends on the amount of money and the material available. Remember—a fence is useless unless the gate is kept closed at all times. (See Chapter III on fencing for detailed instruction of procedure and requirements.)

A good fence will keep out all animals except small ones such as rats. Any effective rat poison placed around the garden will control the rats. But be careful—children and domestic pets have been known to eat rat poison. Zinc phosphide is a good poison readily available in most villages. Warfarin,* an excellent rat poison, will soon be available in India.

2. *Insects:* Insects can destroy your garden. The best method of prevention is to spray or dust regularly with insecticide. There are two general groups of insects: Chewing and sucking types. Chewing insects are usually larger than sucking ones. They leave noticeable holes in the leaf and in some areas bore into the stem. Sucking insects insert their mouths into the plant and suck out vital juices. The effected areas of the plant will be stunted and deformed and will eventually dry up.

If a few simple steps are taken, insects can be controlled. Spray after the leaves mature and every four to six weeks as a preventive measure. Watch for pests regularly. Check plants with a flashlight at night because many insects are nocturnal feeders. If you see a large

* Produced by the Western India Fine Chemical Co., 16 Apoll. Street, Bombay.

pest, destroy it. This is particularly effective with slugs and snails. Destroy old plants soon after harvest. Do not let weeds accumulate. Both old plants and weeds are excellent breeding grounds for pests.

If your garden is infested with insects, do not delay. Determine what insecticide will be most effective and use it immediately. Time is most important. Ask a block or district agricultural expert for advice. He is a trained agricultural graduate with much experience in fighting insects. DDT and BHC are two good all-purpose insecticides. They can be used to control most sucking and leaf-eating insects. When a garden is infested with a particular insect which can be identified, you should use a more specific spray designed to control that insect. At the end of this chapter there is a listing of common insecticides and their use.

3. *Fungus Diseases:* Fungus diseases, like insects, can destroy your garden. There are certain methods to prevent fungus disease. Purchase disease-free seeds and dust seeds with fungicide before sowing. Use well-drained, aerated soil, and practice preventive spraying or dusting. See the listing of common fungicides at the conclusion of this chapter.
4. *Virus Infections:* Many diseases found in the garden are caused by virus infections. The disease is usually transmitted by insects. When an insect first feeds on a diseased plant and then moves to a healthy one, it carries the virus and injects it into the plant. Virus diseases are also spread, however, by contact between healthy and diseased plants. Viruses can be spread by using cutting, tubers, or bulbs from a diseased plant.

Symptoms of virus infected plants vary. The plants are usually stunted and unhealthy. First evidence of the disease appears on the leaves. The leaf will look mottled with a mosaic appearance, and the veins will have a yellowish cast. Be careful not to confuse virus diseases with nutrient deficiencies. (Lack of vital nutrients such as nitrogen, phosphorus and potassium often cause symptoms similar to those of viral infections.) If you are in doubt, contact the Agricultural Extension Officer or District Agricultural Officer.

It is impossible to treat a virus disease. Once a plant is infected, it must be removed and destroyed (buried or burned). Control of insect vectors will prevent the spread of the disease. But the best preventive measure is to select varieties of plants that are resistant to viruses, e.g., Pusa Suwani, a variety of Lady's Finger which is highly resistant to leaf-vein mosaic disease.

Methods of application of insecticides and fungicides may be learned from the AEO or DAO. Usually spray equipment is available from the Block Headquarters. If you have your own equipment or are borrowing equipment, be sure to keep it clean. Rinse the container and spray nozzle and tube thoroughly before and after each use. The residue of one solution can affect the results of the next spraying.

Warning :

With poisons, insecticides and fungicides, as with rat poison, extreme care must be taken. Most of these products are very dangerous. Follow these simple rules rigorously :

1. All insecticides are poisonous. Hence, do not handle with bare hands, nor allow bare parts of body and clothing to come in contact with the spray. If so contacted, wash immediately with soap and water. Be especially careful if the eyes are affected in any way.
2. Keep the insecticide containers away from foodstuffs and out of the reach of children and pets.
3. Do not smoke or chew while spraying or dusting.
4. When spraying crops, the *final spray must be timed at least two weeks before harvest.*
5. Destroy insecticide containers when empty.
6. If poisoning should occur, call a physician immediately.

COMMUNITY HEALTH CELL
326, V Main 1 Block
Koramangala
Bangalore-560034
India

In addition to the insecticides and fungicides listed in the following chart, *Parry's Ltd.* publishes pamphlets and detailed information and instructions on each of their products in this field. Be sure to ask about *Endrin* and *Malathion*. Both are general insecticides and the latter is noted for its low toxicity to man. In a small garden, the problems of selective spraying or dusting might be mitigated by use of such a general insecticide if available. Write to :

E.I.D.—Parry Ltd.
Fertilizer Dept. (I & F)
DARE House
Madras 1, Madras

PESTS AND DISEASES ON VEGETABLE CROPS AND THEIR CONTROL

- | | |
|------------------------------|---|
| 1. Brinjal Plant (Egg Plant) | 11. Knol-Khol |
| 2. Tomato | 12. Pumpkin |
| 3. Pepper and Chillies | 13. Gourds (Ridge, Bottle, Ritter, Snake) |
| 4. French Beans | 14. Cucumber |
| 5. Peas | 15. Coccinia |
| 6. Lima Beans | 16. Potato |
| 7. Cluster Beans | 17. Beet Root |
| 8. Okra | 18. Carrot |
| 9. Cabbage | 19. Radish |
| 10. Cauliflower | 20. Greens |

Insecticide Fungicide

Insecticide Fungicide	Concentration	Pest or Disease	Crops	Direction
1. D. D. T.				
(a) Dust	50%	Caterpillars & Maggots	1,3,5,8 to 14,19,20	
		Thrips	2,3,4,16	
		Mites	4,5,8	
		Aphids	5,6,9 to 15,19	
		Jassids	4,8	
		Beetles and Weavils	1 to 4,16	
(b) Wettable Powder	50%, $\frac{1}{2}$ kg. in 75 liters of water	For all the above mentioned pests.	All the above mentioned crops. (Except cabbage, cauliflower, potato, and cucurbits)	
2. B. H. C.				
(a) Dust	5-10%	—do—	—do—	
(b) Wettable Powder	$\frac{1}{2}$ kg. in 75 liters water	—do—	—do—	
3. Hongey oil resin soap and fish oil resin soap	$\frac{1}{2}$ kg. soap in 18 liters of water	Aphids	Lima Beans	

Insecticide Fungicide	Concentration	Pest or Disease	Crops	Direction
4. (A) Folidol (Liquid)	0.2%—0.5% (2 to 5 cc in one liter of water) Spray	Caterpillars & Maggots	1,2,3,5,8 to 14, 19,20	This is a deadly poison. All given instructions should be strictly followed. —do— —do— —do— —do— —do—
	—do—	Borers	Brinjal	
	—do—	Thrips	2,3,4, & 16	
	—do—	Mites	5,6,9 to 15,19	
	—do—	Jassids	4 & 8	
	—do—	Beetles & Weavils	1 to 4,16	
(B) Folidol Dust	2%	All the above pests except borers	—do—	—do—
5. Hexidol 950 with Sultaf	500 grams. Hexidol-950 & 500 gms. Sultaf in 112½ litres water	Thrips, leaf spot and Chilly leaf curl		
6. Cerason (Seed fungicide)	12 grams powder for 12 kg. seeds	Seed borne diseases and other spores in the soil which attack seeds after sowing	All seeds	
7. Bordeaux mixture	1% cooper sulphate 2.5 kg. and fresh lime 2.5 kg. in 250 litres water. Dissolve copper sulphate in 50 litres water (if) the copper sulphate is tied in a sack cloth & left hanging over night in water, it will have dissolved by morning). Add 150 litres of	Powdery mildew Anthracnose Septoria Carcospora Early Blight Late Blight	On most crops Beans Tomato Brinjal, Tomato, Chilly, potato —do—	Should be prepared in wooden or earthen vessels only.

Insecticide Fungicide	Concentration	Pest or Disease	Crops	Direction
<p>water to solution. Pour enough water to cover the lime, leave for a short time and then add the remaining water to it & strain. To this add copper sulphate solution little by little & stir well with a stick. Copper will be deposited on a clean steel knife blade left immersed in the solution for a minute, if lime is not sufficient. If this happens add more lime.</p>				
8. Cupravit	Spray a solution of 5 kg. powder in 250 litres of water.	All the diseases mentioned for Bordeaux mixture.	All crops mentioned under Bordeaux mixture.	Should be prepared in wooden or earthen vessels only.
9. Keerti Copper				
10. Blitox				
11. Formal-dehyde :	1 % (100 cc in 1 litre of water)	Smut	Onion	
12. Ultra-sulphur :	3 % (3gms. in 10 litres of water)	Rust	Beans & Peas	
13. Dusting Sulphur	—	Rust & Red Spider mites	—do—	

All insecticides and fungicides are usually poisonous. Care should be taken while using them. Only the important precautions are mentioned above. For other precautions see the instructions given along with the fungicides and insecticides.

IX. Planning

Planning your garden in advance is a necessary part of any good garden project. Your garden should be a year-round one and each aspect should be planned accordingly. Before you make a plan, think about the season, the growing period of each vegetable, the production period, and whether it is planted directly by seed or transplanted from a seed bed. (Most of this information is furnished in the charts of Appendix A-1 & 2.) You should note down the fertilizer requirements and irrigation methods chosen, and plan the location of each type of vegetable. *Coordinate* these aspects. For example, if planting tomatoes in July, canal irrigation will help keep the excess rain water away from the base of the stem; if planting the same in November, try the tile or pot method or use individual mounds to conserve water.

Helpful Hints :

1. You will want to have as many vegetables per square foot of garden space as possible. One of the best ways to obtain this is to plant quick-growing plants such as radishes in two rows; after three weeks, transplant a long-growing plant such as tomatoes in a central row between. See illustration in Chapter 7.) Before the tomatoes are very large, the radishes will be harvested, leaving the tomatoes room to grow. In this way, you can make the best use of a small area.
2. The general appearance of your garden is important. An attractive and orderly garden area will be noticed and commented upon quickly. It will help interest others in such a project. One way to increase the attractiveness and also to improve the nutritional value of your total garden production is to plant trees around the site. Shade trees are, of course, good, but consider planting such fruit trees as papaya and banana. (Banana or plantain will require more water and so must be placed nearer a water supply.)

Papaya is a fruit with much nutritional value. It may be put in seed beds in May. Since the hot season is a difficult time to grow many vegetables, it is a good time to concentrate on such a project. Plant the seeds six inches apart in one-foot rows in a seed bed. Transplant the seedlings (when 9"—10" high in July or August) in pits prepared in advance. The pits should be 2' x 2' and filled in with soft earth and well-mixed farmyard manure. Plant two seedlings per hold. At

the age of five months and after one year, give a kilo of the following mixture to each tree:

Farmyard Manure	—	20 Kilos
Ammonium Sulfate	—	1 Kilo
Superphosphate	—	3 Kilos
Potassium Sulphate	—	1½ Kilos

Irrigate more frequently in summer. Keep only one plant per pit and one fruit (developing) per leaf. Remove surplus fruit when they are the size of marbles. Harvest the fruit when slightly yellow.

(For additional information about fruit trees, consult the Horticultural section of the Agricultural Department in your state.)

3. Never leave the soil unsown for any length of time. Soil that has been plowed is especially prone to erosion by wind and water. During the summer months plant a green manure crop in large portions of your garden in preparation for the coming rainy season garden. (See Chapter IV.)

The suggested plan for a 20' x 20' garden is based upon suggestions made by the Andhra Pradesh Government. Adjustment must be made for North Indian climatic conditions.

PLAN—YEAR-ROUND GARDEN—20'×30'

(Dates—Planting to Last Harvest)
or Transplanting

9'		9'	
<p>Amaranth (June, July-Sept.) Followed by ; Bottle Gourd (Nov.-Feb.) Followed by : 5' Green Manure Crop (Summer)</p>	<p>P A T H W A Y — 2 ' W I D E</p>	<p>Ceylon Spinach (June-Aug.) Followed by : Spinach (Nov.-Feb.) Followed by : Green Manure Crop (Summer)</p>	
<p>Pumpkin, Gourds (June, July-Oct.) Followed by : Cowpea (Nov.-Mid-Mar.) 5' Followed by : Green Manure Crop (Summer)</p>		<p>Early Cauliflower (Aug.-Oct.) Followed by : Onion (Nov.-Mar.) Followed by : Green Manure Crop (Summer)</p>	10'
<p>Field Beans (June-Feb.) Followed by : 5' Green Manure Crop (Summer)</p>		<p>Tomato (July-Oct.) Followed by : Lettuce, Cabbage, Knol-Kohl, (Kohl Rabi) (Nov.-Feb.) Followed by : Green Manure Crop (Summer)</p>	10'
<p>Cluster Beans (April-July) Followed by : Brinjal (Nov.-Mar.) 5'</p>			

Radish (July-Aug.) Followed by :	P A T H W A Y - 2 ' W I D E	Bhindi (Lady's Finger) (July-Oct.) Followed by :	10'
Turnip (Aug.-Oct.) Followed by :		Radish, Carrot Mixed (Nov.-Jan.) Followed by :	
Tomato (Nov.-Mar.) 10'		Cluster Beans (Mar.-May, June)	
Followed by : Summer Squash (April-June)		Bhindi (Lady's Finger) (July-Oct.) Followed by : Sweet Potato Cuttings (Nov.-Mar.) Followed by : Cluster Beans (Mar.-May, June)	

X. Maintenance

Maintaining the garden is work. But, if you plan and schedule your care of the garden, it will be much easier and you will reap a rich harvest. Here are some hints to help make maintenance easier:

1. *Scheduling:* Work out a schedule of garden duties—Watering, weeding and cultivation, spraying for insects, checking the garden for diseases, etc. Then stick to the schedule. If you know you should have weeded the garden several days ago, but won't go near it because of the discouraging sight it has become, your garden is sure to be unsuccessful.
2. *Mulch:* In the hot season, use a mulch to help hold the water in the soil so that you don't have to irrigate every day. A mulch is any organic waste product (peat moss, paddy husk, sugar cane waste, sawdust, groundnut husk, straw) that is put on top of the soil to a depth of 1"—2".
3. *Staking:* Many vegetables must be supported so that their fruits do not rest on the soil. Tomatoes should be staked or wires should be strung above the rows and plants tied to the wires. Certain gourds and climbing beans should be trained against a fence, a wall, or a pole or trellis. Prompt staking prevents rotting and crowding of the plants. Be sure not to delay. (See illustration 18.)
4. *Variety:* Arrange garden work so that there is variety in the garden tasks. Don't plant all the seeds at once. Each week do a little planting. Soon your garden tasks will be varied and interesting—a little planting or transplanting, a little weeding and spraying, some thinning, some harvesting. Don't forget to fertilize at intervals. Keep your eyes open and keep track of your observations. You might even run some experiments in the garden to add interest.
5. *Weeding:* Weeding is the most unpleasant gardening task. Try to make it easy and pleasant. Make it part of a routine, and do it *frequently*, during a cool part of the day. Different methods appeal to different people. Some like to cultivate with a hoe to eliminate or prevent weeds. Others pull them up by the roots. The latter necessitates moist soil. Take care not to disturb the vegetables in your war against weeds. Frequent weeding makes this easier. Remember—weeds will use up much of the fertilizer and water intended for your vegetables if you allow them to grow unchecked.

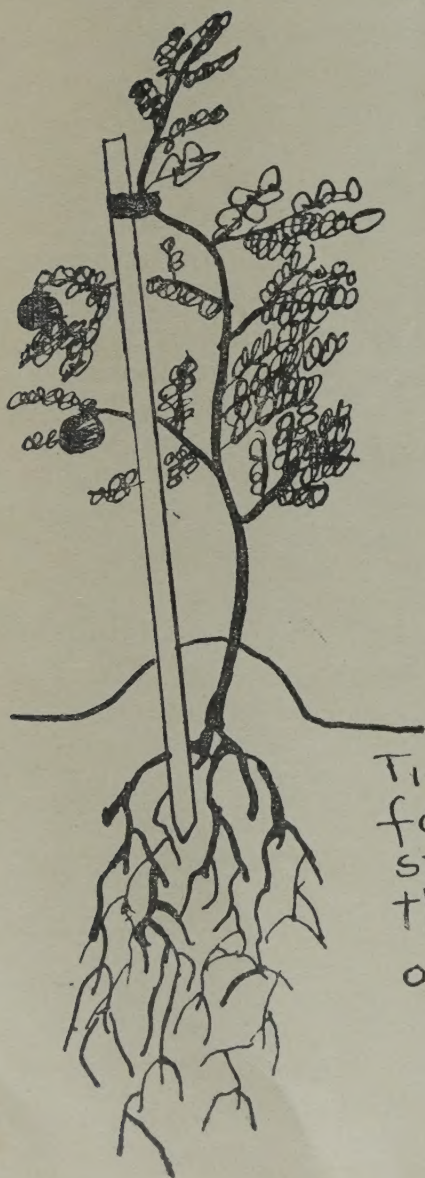
6. **Cultivation:** Cultivation means keeping the soil loose and uncaked by hoeing and working it. Cultivation is necessary, not only because it is a method of weeding but also because it breaks up the soil. Making it easier for plants to grow, and because it helps the soil to absorb and retain water. Using canals makes cultivation less necessary because the soil at the top of each row never is soaked (in the dry season) and thus remains uncaked. The soil in the canals does not need to be cultivated. Limit the number of cultivations to a few hoeings and be careful not to disturb the root structure.

18. Staking Vegetable Plants



above

The Wire-Pole Method
Tie the stem of the plant loosely to the wire, allowing room for growth.



The Individual Stake Method
Tie the stem to a stake placed in the ground fairly close to the base of the stem. Be sure to replace dirt and pack dirt around the base of the plant to prevent exposure of the roots to air.

XI. Extension Methods in Garden

In some cases it may be possible to build an entire extension program around the gardens you will plant or help to plant. This is especially true if you are working with a school garden. A garden at a school can be a showpiece, will interest villagers in kitchen gardens, and teach children the value of gardening. Think about the following suggestions:

1. Your presence should not be the only incentive for the garden. Make sure the Headmaster and teachers are interested. Perhaps they would like to have a demonstration garden of their own.
2. Make a regular schedule for your visits and go every time on time. Children will begin to look forward to your visits. Plan on going in the cool part of the day; morning and evening are best.
3. Make a regular schedule for the garden work. As an instruction method, have your plans for each week and any detailed information printed up in the local language and distribute regularly. In this way the children will accumulate personal books on garden procedure and their interest will be maintained.
4. You may start a youth club using the garden as its focal point. To maintain interest, give points for attendance and a prize for the best garden. Individual plots for the children can be outlined and labeled. With a youth club or without, individual plots will foster healthy competition and give each his own responsibility. (Remember, however, that individual plots will cut down on the total production through waste of space. It is better in a kitchen garden and in at least one section of a school garden to have larger plots.) You may also sponsor class gardens.
5. Have a village or block fair at the end of a garden season and offer prizes. Both kitchen and school gardens can be included.
6. If you have several school gardens, try to have a monthly meeting of the involved teachers. Remember—they will be ultimately responsible for the success of the garden, not you.
7. If each child or a group of children are put in charge of smaller plots within the large plot, label this plot. This is simply done by placing a stake in his plot with a 2" board at the top—write his name on this board. Will encourage competition among the plot holders.

XII. Simple Steps in Gardening

Either before you plant the garden or after, you should construct seed beds for the plant which need transplantation. It is easier to grow successful tomato plants, and brinjal if you first start them in a seedbed. Take care to weed the beds daily and to water them at least twice a day.

The following steps may help in the starting of a garden:

1. Clean the garden area first.
2. Erect the fencing. (See Chapter III)
3. Dig down at least 8-10 inches.
4. Break up the clods.
5. Take out all the weeds, weed roots, stones & sticks.
6. Make the earth fine and level.
7. Add and mix-in fertilizers and/or manures. (See Chapter IV)
8. Make the ground level and smooth again.
9. If a large group, work in lines to avoid accident.
10. Plan the garden layout. (See Chapter IX) (See Appendix A)
11. Plan the seeds, leave space for transplants.
12. Water by sprinkling lightly.
13. Weed the garden daily. Do not let the weeds get above two inches.
14. Keep the soil loose enough around the plants to allow free movement of water and air, but do not expose the roots.
15. Keep a sharp eye open for the first signs of insect attack and spray the plant as soon as possible. Follow the directions about dosage carefully. (See Chapter VIII.)
16. Add more fertilizer after about three weeks.
17. Keep the irrigation canals at the recommended depth to avoid uneven water distribution.
18. Use common sense; It's your garden